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DEVICE FOR CATALYTIC CONVERSION HAVING A SUPPORT BODY WHICH IS ATTACHED TO A CASING IN CERTAIN AREAS

Cross-Reference to Related Application:

This application is a continuation of copending International Application PCT/EP00/05123, filed June 5, 2000, which designated the United States.

Background of the Invention:

Field of the Invention:

The subject matter of the invention relates to a device for the catalytic conversion of at least one component of an exhaust gas, in particular of an exhaust gas from an internal-combustion engine. The device has a metallic support body formed from a plurality of layers of corrugated or corrugated and smooth metal sheets. A casing at least partially surrounds the support body and is connected thereto. The support body has at least one outer layer formed from smooth sheet metal sections that overlap one another.

International Patent Disclosure WO 92/18758 discloses a device for the catalytic conversion of at least one component of an exhaust gas, in particular of an exhaust gas from an internal-combustion engine. The device contains a metallic support

body and a casing. The support body is formed from a plurality of layers of corrugated or smooth and corrugated metal sheets. It has at least one outer layer formed by smooth sheet-metal sections that overlap one another. The support body is surrounded by the casing and connected thereto. According to International Patent Disclosure WO 92/18758, the support body is connected to the casing by at least one weld seam. The weld seam is preferably produced by laser welding.

Furthermore, devices for the catalytic conversion of at least one component of an exhaust gas in which the support body is soldered to the casing are known. The support body is in the form of a monolithic body. For this purpose, the sheet-metal layers are at least in some cases soldered to one another. The soldered connection or connections between the sheet-metal layers and between the support body and the casing is/are preferably formed in a single soldering operation. Processes for soldering a device including a support body and a casing are known, for example, from International Patent Disclosure WO 89/11938 and Published, Non-Prosecuted German Patent Application DE 29 24 592 A1.

When the device is being used for the catalytic conversion of at least one component of an exhaust gas from an internal-combustion engine, the device is subject to thermal loads. On

account of their different material properties, the metallic support body and the casing undergo different thermal expansion. Therefore, it is endeavored to avoid a rigid connection between the support body and the casing.

To this end, it is proposed, according to International Patent Disclosure WO 96/26805, for at least one sheet-metal layer of the support body to have at least one smooth section which extends from at least one end side over part of the axial length of the support body and at least partially surrounds the support body. On the circumference of the support body, the smooth section forms a layer that bears against the casing. As a result, no solder is allowed to be present between the outer layer and the tubular casing, irrespective of the soldering process used. Therefore, the solder can be applied in the way which is known from the prior art. The support body is connected to the casing over part of the axial length of the casing, the smooth section extending in the axial direction of the support body only as far as the connecting area between the support body and the casing.

Summary of the Invention:

It is accordingly an object of the invention to provide a device for catalytic conversion having a support body which is attached to a casing in certain areas which overcome the above-mentioned disadvantages of the prior art devices of this

general type, in which a load on the support body, in particular caused by tensile stresses, is reduced.

With the foregoing and other objects in view there is provided, in accordance with the invention, a device for catalytically converting at least one component of an exhaust gas, including the exhaust gas from an internal-combustion engine. The device includes a casing and a metallic support body formed from a plurality of layers of sheets. The casing at least partially surrounds the metallic support body and is connected to the metallic support body. The sheets are corrugated metal sheets or corrugated and smooth metal sheets. The metallic support body has at least two outer layers formed from smooth sheet-metal sections overlapping one another. The at least two outer layers are formed substantially diametrically opposite one another and in each case have connection-free areas with respect to the casing.

The device according to the invention for the catalytic conversion of at least one component of an exhaust gas, in particular of an exhaust gas from an internal-combustion engine, has the metallic support body that is formed from a plurality of layers of corrugated or smooth and corrugated metal sheets. The support body is disposed in a casing that at least partially surrounds the support body and is connected thereto. The support body has at least one outer layer that

is formed by smooth sheet-metal sections that overlap one another. The device according to the invention is distinguished by the fact that at least two layers, which are formed substantially diametrically opposite one another, are provided. The layers in each case form connection-free areas with the casing.

The inventive configuration of the invention results in the load on the device being reduced. In particular, the occurrence of tensile stresses in the radial direction is reduced, if not altogether, then at least to such an extent that, in particular under thermal loads involving substantial and rapid temperature changes, failure of the support body is prevented. The radial tensile stresses are avoided by the fact that the support body is only partially connected to the casing.

Possible axial tensile stresses are absorbed by the support body, since it is connected to the casing via diametral connecting areas. The connecting areas lie between the connection-free areas.

The angle included by the respective layer, as seen in the circumferential direction of the support body, is preferably adapted to the particular load situation. It is proposed that the included angle may also be over 180° if the load on the

support body includes high vibrational components. Small angles (i.e. less than or equal to 180 degrees) are preferred in the event of high thermal stresses, in particular if there are thermal shocks in the radial direction.

Production of a device according to the invention can be simplified by making the angles of the two layers substantially identical. Therefore, the support body does not have a preferred orientation in the casing.

According to yet another advantageous configuration of the device according to the invention, it is proposed for the layers to be formed adjacent to the respective end face of the support body.

According to yet another advantageous configuration of the device, it is proposed for the length of the respective layer to be less than half the total length of the support body. This has the advantage of providing the support body with a considerable compensation distance within the tubular casing. The lengths of the layers are preferably identical. This has the advantage that the support body can be disposed in a directionaly-indepenent manner in the tubular casing.

According to yet another advantageous configuration of the invention, it is proposed for at least some of the sheet-metal

sections to be formed by end sections of at least some of the metal sheets, preferably of the smooth metal sheets. This has the advantage that the end sections are formed integrally with the metal sheets. Alternatively, at least some of the sheet-metal sections may be formed by sheet-metal strips, in each case one sheet-metal strip being disposed between two adjacent metal sheets. This embodiment has the advantage that it is easier to cut the metal sheets to size.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in a device for catalytic conversion having a support body which is attached to a casing in certain areas, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Brief Description of the Drawings:

Fig. 1 is a diagrammatic, front-elevational view of a device according to the invention;

Fig. 2 is a diagrammatic, sectional view through the device;

Fig. 3 is a diagrammatic, enlarged, sectional view of a layer and a casing;

Fig. 4 is a diagrammatic, perspective view showing a stack of sheet-metal layers;

Fig. 5 is a diagrammatic, perspective view of a second exemplary embodiment of the stack of sheet-metal layers;

Fig. 6 is a diagrammatic, perspective view of a third exemplary embodiment of the stack of sheet-metal layers; and

Fig. 7 is an illustration of a smooth metal sheet of the stack as shown in Fig. 6.

Description of the Preferred Embodiments:

Referring now to the figures of the drawing in detail and first, particularly, to Fig. 1 thereof, there is shown a device for the catalytic conversion of at least one component of an exhaust gas, in particular of an exhaust gas from an

internal-combustion engine. The device has a metallic support body 1. In the exemplary embodiment illustrated, the support body 1 is formed from a plurality of layers of corrugated metal sheets 3 and smooth metal sheets 4. The metal sheets 3, 4 are bent in an S shape. Other configurations of the support body 1 are possible.

The support body 1 is disposed in a casing 2. In the exemplary embodiment illustrated, the casing 2 surrounds the support body completely, as shown in particular in conjunction with Fig. 2. The support body 1 is connected, in particular soldered, to the casing 2. The casing 2 is preferably of a tubular configuration.

Fig. 2 shows that the support body 1 has two outer layers 6, 7. Each of the outer layers 6, 7 is formed by smooth sheet-metal layers 5 which overlap one another (Fig. 3). The two layers 6, 7 are formed substantially diametrically opposite one another (Fig. 2). The layers 6, 7 are disposed adjacent to respective end faces 10, 11 of the support body 1. Fig. 2 shows that the length l of the respective layer 6, 7 is less than half a total length L of the support body 1. The lengths l of the two layers 6, 7 are preferably equal.

The respective layer 6, 7 is formed by the smooth sheet-metal sections 5 which overlap one another. An angle α, which is

formed by the respective layer 6, 7, as seen in the circumferential direction of the support body 1, is preferably approximately 180° (see Fig. 1). In the exemplary embodiment illustrated, the angles α are identical. This is not imperative. The angle α may also vary in the axial direction of the support body.

The outer layers 6, 7 prevent solder from passing in-between the metal sheets and the casing 2 during the end-side soldering of the support body 1, so that there is no connection between the support body 1 and the casing 2 in the region of the layers 6, 7. There is a connection between the casing 2 and the support body 1 at locations where the support body 1 does not have the outer layers 6, 7. In Fig. 2, the connecting area between the support body 1 and the casing 2 is provided with the reference numeral 8, 9. The configuration of the support body 1 with the two layers 6, 7 results in that the connecting areas 8, 9 also lie diametrically opposite one another.

The fact that the support body 1 has connection-free areas results in that it is possible to reduce the radial and axial tensile stresses acting on the body. In particular, the stresses are reduced by the corrugated metal sheets 3.

Fig. 3 shows an enlarged view of a part of the support body 1 with the outer layer 6 bearing against the casing 2. In the exemplary embodiment illustrated, both the corrugated metal sheets 3 and the smooth metal sheets 4 have the smooth sheet-metal sections 5 which overlap one another and form the outer layer 6.

Fig. 4 and Fig. 5 show exemplary embodiments of sheet-metal stacks that are suitable for forming the support body 1. Fig. 4 shows that only the smooth metal sheets 4 have the smooth sheet-metal sections 5. The corrugated metal sheets 3 do not have the sheet-metal sections 5. The smooth metal sheet 4 and the smooth sheet-metal sections 5 are formed integrally. It can be seen from Fig. 4 that the sheet-metal sections 5 are formed diametrically opposite one another.

Fig. 5 shows a further exemplary embodiment of the stack of metal sheets 3, 4. The corrugated metal sheets 3 and the smooth metal sheets 4 form the stack, the metal sheets 3, 4 forming a substantially rectangular blank. The sheet-metal sections 5 are formed by sheet-metal strips 5 that are fitted between the adjacent metal sheets 3, 4. The sheet-metal sections 5 may also be connected to the smooth metal sheet 4 and/or to the corrugated metal sheet 3. The connection may, for example, be an adhesive bond.

Fig. 6 shows a stack of metal sheets 3, 4. The smooth metal sheet 4 is disposed between two adjacent corrugated metal sheets 3. The first and last layers of the stack may also be formed by the smooth metal sheet 4, as is illustrated by Fig. 6.

In the exemplary embodiment illustrated, the corrugated metal sheets 3 form a substantially rectangular blank.
The smooth metal sheets 4 are configured in the form of a parallelogram. They have respectively opposite sheet-metal sections 12, 13 that protrude laterally beyond the corrugated metal sheets 3. The sheet-metal sections 12, 13 overlap one another when the stack is wound in an S shape.

The embodiments of the metal sheets illustrated in the figures represent preferred configurations. It is also possible, for example, for the sheet-metal sections 12, 13 illustrated in Figs. 6 and 7 to be configured in such a manner that they extend over only part of the axial length.